

Patent claims:

1. A separator especially for lithium high energy batteries, comprising a sheetlike flexible substrate having a multiplicity of openings and having a porous inorganic coating on and in said substrate, the material of said substrate being selected from a nonwoven of electrically nonconductive polymeric fibers, characterized in that the separator has a weight of less than 50 g/m<sup>2</sup> and a thickness of less than 35 µm and in that the porous inorganic coating is constructed from oxide particles having a primary particle size of from 5 to 100 nm and adhered via SiO<sub>2</sub> or ZrO<sub>2</sub>.  
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- 15 2. The separator of claim 1, characterized in that it has a weight of less than 20 g/m<sup>2</sup>.
- 20 3. The separator of either of claims 1 and 2, characterized in that said polymeric fibers are selected from fibers of polyacrylonitrile, polyester and/or polyolefin.
- 25 4. The separator of at least one of claims 1 to 3, characterized in that said polymeric fibers are from 0.1 to 10 µm in diameter.
- 30 5. The separator of at least one of claims 1 to 4, characterized in that said flexible substrate has a porosity of from 50% to 97%.
- 35 6. The separator of at least one of claims 1 to 5, characterized in that said flexible substrate is less than 30 µm in thickness.
7. The separator of claim 6, characterized in that said nonwoven is less than 20 g/m<sup>2</sup> in weight.

8. The separator of any of claims 1 to 7, characterized in that said coating on and in said substrate comprises an oxide of the metals Al, Zr and/or Si.

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9. The separator of at least one of claims 1 to 8, characterized in that it has a porosity of from 30% to 80%.

10 10. The separator of at least one of claims 1 to 9, characterized in that it has a breaking strength of more than 1 N/cm.

11. The separator of at least one of claims 1 to 10, characterized in that it is bendable around a radius down to 100 m without damage.

12. The separator of at least one of claims 1 to 11, characterized in that it is bendable around a radius down to 0.5 mm without damage.

13. A process for producing a separator as claimed in at least one of claims 1 to 12, characterized in that it comprises providing a sheetlike flexible substrate having a multiplicity of openings with a coating on and in said substrate, the material of said substrate being selected from nonwovens less than 30  $\mu\text{m}$  in thickness of electrically nonconductive fibers of polymers and said coating being a porous electrically insulating ceramic coating which is prepared by applying a suspension to said substrate and heating one or more times to solidify said suspension on and in said substrate, the suspension being obtained by suspending metal oxide particles of at least one oxide of the elements Al, Zr and/or Si, which have a primary particle size of from 5 to 100 nm, in a sol of at least one of the elements Si and/or Zr.

14. The process of claim 13, characterized in that said fibers are selected from polyacrylonitrile, polyester or polyolefin.

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15. The process of either of claims 13 and 14, characterized in that said suspension is brought onto and into said substrate by printing on, pressing on, pressing in, rolling on, knifecoating 10 spreadcoating on, dipping, spraying or pouring on.

16. The process of any of claims 13 to 15, characterized in that said sol is prepared by 15 hydrolyzing at least one alkoxide compound of the elements Zr, Al and/or Si or at least one nitrate, carbonate or halide of the elements Zr, Al and/or Si.

20 17. The process of at least one of claims 13 to 16, characterized in that metal oxide particles having an average primary particle size of from 7 to 50 nm are suspended.

25 18. The process of at least one of claims 13 to 17, characterized in that the mass fraction of said suspended component is from 1 to 100 times that of the sol used.

30 19. The process of at least one of claims 13 to 18, characterized in that said suspension present on and in said support is solidified by heating at from 150 to 500°C.

35 20. The process of claim 19, characterized in that said heating is effected at from 200 to 280°C for from 0.5 to 10 minutes.

21. The use of a separator as claimed in at least one of claims 1 to 12 as a separator in lithium batteries.
- 5 22. A battery comprising a separator as claimed in at least one of claims 1 to 12.